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The Professional Work of *Hinge Objects*: Inter-Professional Coordination in Urban Drainage

Abstract: Recent developments in sustainable urban drainage have turned the area, formerly controlled by engineers, into a professional field encompassing engineers, landscape architects, and urban planners. Through interviews, fieldwork, and document analysis of three Danish cases of urban rainwater management, the article shows how these three different professions, in drawing upon the specific Danish concept of LAR (Local Diversion of Rainwater), compete with each other but also coordinate their work tasks. The article proposes the concept of *hinge object*, inspired by Star and Griesemer's boundary object and Abbott's work on hinges, to capture how LAR serves as a coordinating object among professions, but also among professions, the state, and universities.

Keywords: Urban drainage, engineers, landscape architects, Abbott, boundary object

Recent changes in the field of urban rainwater management and drainage have led to an opening for new professionals in this field, which has previously been dominated by wastewater engineers. More rain as a result of climate change is challenging the existing rainwater infrastructure and in Denmark has resulted in a political awareness of the problem of urban rain and drainage. Together with an increased focus on the greening of cities and more urban nature, this opens the area to landscape architects and urban planners, who combine the draining of rain with building greener cities by draining rainwater on the surface. Different conventions of legitimate coordination are beginning to establish themselves in this field of sustainable urban rainwater management and drainage, but the three professions—engineering (mostly wastewater and environmental), landscape architecture, and urban planning—still compete to some extent over which new (or old) techniques should be used for draining urban rainwater.

In the international community of sustainable urban drainage, these techniques consist of, for instance, Sustainable Urban Drainage Systems (SUDS), Low Impact Development (LID), and Water Sensitive Urban Design (WSUD). In Denmark, the concept of LAR (translated into English as Local Diversion of Rainwater) is the most commonly used for specific rainwater drainage techniques that drain rainwater on the ground (through rain beds and so on) instead of leading it into the sewers, where it potentially floods the system. LAR is used widely by engineers, landscape architects, and urban planners. But there is a discussion among the different professions about what is covered by the concept, how it should be used, and what it provides a solution for. These discussions take place in professional, governmental, and research networks, which are constituted not only by professional actors, but also by

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actors from universities, municipalities, and state agencies. To understand how inter-professional work is organized and arranged in this new, emerging field, I analyze how professionals define, discuss, and work with the concept of LAR. The definitions and discussions are professional, but they are also closely tied to political ideas about greener cities and to the research practices and agendas of university communities.

In this paper, I draw on Andrew Abbott's sociology of professions (2001, 2005) and the sociological work on classification and boundary objects by Star and Griesemer (1989, also Bowker & Star 1999) to analyze LAR as an object that not only coordinates among professions, but also hinges professional groups and discussions on to the political and university field. Based on this analysis, I propose the concept of a *hinge object* to explain this dual way that LAR works in a professional ecology. A hinge object in my definition makes cooperation across multiple, different professional worlds possible while at the same time allowing for alliances on a different level, namely, among the different ecologies (in the language of Abbott): the professional, the political, and the university. The analysis of LAR draws on material gathered by following three different urban development projects in Denmark that deal with climate adaptation and urban rainwater management.

The paper will proceed with a background section, where I briefly contextualize the professional arena of urban rainwater management. Afterward, I elaborate on my theoretical framework and contribution in a theoretical section, which draws on Andrew Abbott's sociology of professions and Star and Griesemer's work on boundary objects. I then describe the data collected for the paper, my methods, and my research logic. In the following empirical sections, I analyze the way that different professions define and work with techniques for urban rainwater management. Lastly, the discussion will show how conceptualizing LAR as a hinge object captures an important aspect of inter-professional work in an emerging professional field: namely, the combination of cooperation and competition among professionals and the linking of this cooperation and competition to other non-professional actors and arenas.

Inter-professionality in urban rainwater management

For a long time in Western cities, ever since the late 19th century, urban wastewater has been channeled underground to the sewage system in pipes, at first directly to recipients (rivers, streams, oceans) and later to water treatment plants. Thus, the management of urban rainwater became was almost entirely the domain of wastewater engineers. But from the 1960s, '70s, and '80s, discussions began transnationally among engineers, biologists, and ecologists about the water quality of urban rainwater runoff (Karvonen, 2011, in Danish see documents from the Danish EPA, Miljøstyrelsen, 1979, 1981, 1990). This increased focus on water quality led to different new management techniques and ideas. Some of these new techniques are conceptualized as LID, SUDS or, in Denmark (around the 1990s), as LAR. In the United States, such techniques are influenced by landscape architects and ecologists, who thereby influence the area of urban rainwater management and drainage as a whole (Karvonen, 2011, p. 19). This presence of landscape architects in urban rainwater management happened later in Denmark, from the late 1990s into the 2000s, but today there is no question that managing urban rainwater is an "interdisciplinary" area of expertise (as described by the actors themselves).

This interdisciplinarity manifests in the way that actors describe professionals in the field: for example, landscape architects may be referred to as "landscape [architects] classic," which describes a certain kind of landscape architect, specifically one focused on aesthetics. In another instance, a professor referred to a landscape architect as a "technical landscape architect," as opposed to the classic landscape architects described above. Someone else called certain building consultants "architects

engineers,” which meant that they were educated as architects but understood knew all the formalities and technicalities of building, whereas an engineer from the utility company was described as an “engineer engineer.” In all these examples, the major dividing line is between the technical and the aesthetic/artistic. This is a typical distinction in the relationship between engineers and architects (see, for instance, Faulkner 2007). The blurring of this characteristic engineer-architect divide is the result of an area of expertise that is, at this moment, extremely interdisciplinary, and where organizing and delegating work tasks is still new and confusing for many, if not all, of the actors. It does not mean a dissolving of professions as a main organizing principle for delegating work tasks because strong ideas about the competences of engineers and architects (and the differences between them) still prevail in the field, and these ideas are backed by the organization of work, where engineers are assigned specific tasks and landscape architects others. Yet the interdisciplinarity indicates the possibility of new specializations forming.

This interdisciplinarity is closely tied to the location of rainwater in these new management techniques: having been managed in infrastructures underground, urban rain is now being managed (to some extent) on the surface. For almost 100 years, then, engineers had almost complete control over calculating, designing, and building sewage systems underground, but the surface of the city is an area where urban planners and (landscape) architects perform and, to a certain degree, control different work tasks. A traditional sewage project, where rainwater is led underground to a treatment plant, does not present complicated issues concerning pollution or installations in protected forest and nature, nor issues regarding waterborne diseases and epidemics. LAR projects, on the other hand, affect a whole new set of related areas: roads, forests, parks, and so on. Therefore, draining rainwater on the surface also means that new types of engineers are becoming involved, for example, road and environmental engineers.

In Denmark, the practice of managing urban water on the surface has been further strengthened by very heavy rains and cloudbursts in 2007, 2010, and 2011, which flooded large areas of the Danish capital, Copenhagen, and led to an increased political awareness of the limited capacity of the urban sewage systems. There is professional agreement around the fact that the current system is not equipped to handle the increased amounts of rain. Expanding the existing systems poses economic and technical obstacles in urban settings, where there is little room for larger pipes and a greater risk of flooding owing to large fortified areas. Therefore, urban rainwater is managed on the surface and LAR plays an important role in this new way of managing rain.

The field of urban rainwater management and drainage has, then, in the last 50 years developed from a largely mono-professional area to a field where different professions claim expertise. As described, this change has been driven by new environmental problems, but instead of leading to the forming of a new profession, these new tasks are being integrated into existing professions, especially those of engineering and landscape architecture, as Mieg and others have also shown in Switzerland (Mieg, de Sombre & Näf. 2013). In Denmark, the practice of managing water on the surface has also transformed the field from being dominated by one organization, the utility company, to involve more organizations and businesses, where the tasks and responsibilities are distributed in new ways. These novel ways of managing urban rainwater thus involve much more coordination among a wider set of organizational actors and professions.

Theoretical contribution: Towards professional hinge objects?

Following Andrew Abbott's sociology of professions (2001, 2005), I understand the professional system as an ecology linked with other ecologies. The concept of ecology signifies a changing relational professional space, where professions and professional organizations construct and constitute the boundaries for other professions. This puts the inter-professional struggles over *jurisdictions* at the centre of the sociological analysis (for other analysis of the professional jurisdiction, see, e.g., Fourcade, 2006; Suddaby & Viale, 2011). Jurisdictions are the link between professions and a particular task over which certain professions claim control. A central point in Abbott's sociology (2005) is that professional work and claim-making are linked to other arenas, the university, and political ecology, where similar battles for control take place. Professions are thus arenas shaped by jurisdictional battles within and between different professions, and jurisdictional struggles in the professional ecology are also fought within a broader ecological landscape.

In the university arena, the locations that actors try to control are called *settlements*. This term can refer to a body of more or less controlled knowledge or a special faculty and may involve, for instance, research practices (Abbott, 2005, p. 250). Another ecology is the political, where *bundles* (Abbott, 2005) correspond to jurisdictions and settlements as the areas in which political issues are transformed and where political actors try to exercise control. Examples of a political bundle might be social policy, deregulation, or climate adaptation.

An alliance between two or three of the different ecologies is called a *hinge* (Abbott, 2005). A hinge links specific groups of professionals, university researchers, and/or political actors, and offers different rewards in different ecologies. In the field of urban rainwater management, for instance, a hinge could be the Danish municipal climate adaptation plans and flooding maps, which work in the political ecology as a way to deal with the recent floods in Denmark, and which serve in a professional ecology as a roadmap to the locations where interventions should be made in relation to flooding. Forming a specific link between a profession and a political actor is one strategy that a profession can apply when fighting for jurisdictional closure in the professional ecology. Therefore, the struggles between professions often also are tied into links between ecologies. Another link between ecologies can be established when an ecology attempts to create an *avatar* of itself in another ecology (an example of this is when professions seek a place in the university by creating undergraduate disciplines, Abbott 2005, p. 265).

In the professional jurisdiction of urban rainwater management, LAR emerges through the work that professional actors do when they manage rain and urban drainage. It is a concept that different professions use and work with, but one that they also fight over. At the same time, university and political actors are involved, too, in these discussions and struggles. To understand the new inter-professional field of urban rainwater management, it is, therefore, crucial to grasp how professional actors work with and interpret LAR as a central concept in the professional work of urban drainage and rain management.

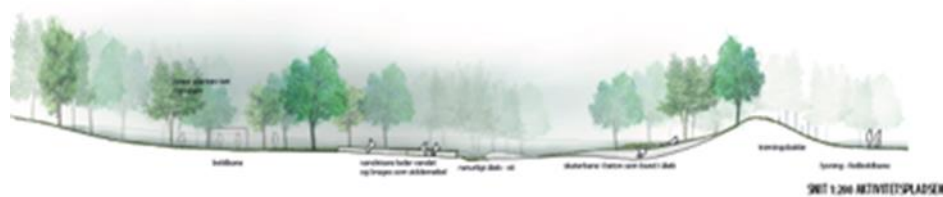
Abbott does not elaborate on what exactly a hinge between ecologies could look like, and the theory does not offer more precise language than the somewhat abstract concepts of hinge and avatar to grasp how different ecologies are linked together. Furthermore, the relations among different professional groups are not explicated other than as battles for autonomy and control. Faced with the field of urban rainwater management, where coordination among many different actors in many different organizational contexts is the norm rather than the exception, a more detailed language of coordination is needed. A conceptually coherent and nuanced language of coordination among different groups that has been used to understand professional cooperation in engineering, for instance (e.g., Bechky, 2003; Faulkner, 2007; Van de Poel, 2008), is the idea of a *boundary object* developed by Star and Griesemer (1989). A boundary object inhabits intersecting communities of practice and can not only adapt to local needs and local meanings in the different communities, but also

maintains a common identity across different locations (Star & Griesemer 1989, p. 393). In joint practices, the object is thus relatively unstructured, but highly structured when used in the different communities (Trompette & Vinck 2009). Thus, it is a coordination device not “engineered as such by any one individual or group, but rather emerged through the process of the work. As groups from different worlds work together, they create various sorts of boundary objects” (Star & Griesemer 1989, p. 408). The object is a way for actors from different communities of practice to coordinate in spite of their different points of view (Trompette & Vinck 2009).

A boundary object can take many forms, and in their work from 1989, Star and Griesemer distinguished among four different types of boundary objects: repositories, ideal types, coincident boundaries, and standardized forms. These types exemplify ways of coordinating work between locations and communities of practice. In the terminology of Star and Griesemer, the concept of LAR can be categorized as a boundary object because the different professions use it to coordinate among themselves but assign to it very different meanings and models (see also Van de Poel 2008 for a conceptualization of engineers’ drawings and models as boundary objects). More specifically, LAR is an *ideal type* (in the Weberian sense of the word, where ideal refers to a coherent whole of typical traits of reality, not the actual, specific thing itself). A boundary object as an ideal type is an object such as a diagram or an atlas:

Which in fact does not accurately describe the details of any one locality or thing. It is abstracted from all domains, and may be fairly vague. However, it is adaptable to a local site precisely because it is fairly vague; it serves as a means of communicating and cooperating symbolically—a “good enough” road map for all parties [...] Ideal types arise with differences in degree of abstraction. They result in the deletion of local contingencies from the common object and have the advantage of adaptability. (Star & Griesemer 1989, p. 410)

LAR demonstrates this quality of abstractness and vagueness. It is a diagram (like the one shown in picture 1 below) that illustrates a cross-section of above and beneath the surface, shows different sorts of green plants and trees, and exhibits where and how the water will stay on the surface in the event of rain.



Picture 1. *LAR as an ideal type–boundary object. Part of the project description for climate adaptation project, The Climate City, GHB Landscape architects.*

This way of picturing LAR is common to landscape architects, urban planners, and engineers but lacks all the important details of their professional work (depth, width, length, material specifications, elevation levels, and so on) and therefore also all the local characteristics of the city. For this diagram to become specific enough, engineers would need to break it down into many much-smaller parts, both longitudinal-

and cross-sections, and into different diagrams with specific measures and description of materials attached to them. The landscape architects would have to make lists of specific plants to put in rain beds and diagrams of how they should be planted. In this way LAR as an ideal type coordinates between professional groups by being vague enough for different professions to adapt it to specific areas and work tasks.

Other studies have shown how boundary objects are not neutral or consensual but can exercise power (e.g., Huvila 2011). In the case of interdisciplinary professional work in urban rainwater management, what matters is that LAR not only coordinates among different communities of professional practice, but also is a contested concept at the heart of the jurisdictional struggles. In these struggles, LAR functions as a central *hinge* between the professional jurisdictional battles over the area of urban rainwater management and other ecologies such as the state and universities. To understand the specific role that LAR plays in the field of urban rainwater management, I therefore suggest that it is a *particular* kind of boundary object that not only coordinates between professions, but also serves as a hinge between the professional ecology and other ecologies. Therefore, I propose the term hinge object to capture this dual role of LAR.

Focusing on LAR also shows that the area of urban rainwater management is not a stable, monopolized jurisdiction, and that the idea of total control is in some ways misleading. This is because the whole point of the new way of managing urban rainwater is that it can do several things at once, which means that different professions benefit from it—and from the fact that other professions are involved.

Data and methods

The main data produced for this paper are interviews, documents, and meeting observations from three Danish urban rainwater management projects, which began in 2012 and are ongoing. All three are urban planning and rainwater management projects that manage water on the surface. Projects like these make good case studies for the coordination practices of different professions, since they involve engineers, urban planners, and landscape architects. The projects specific to my study are trying to solve the problem of heavier rain as a consequence of climate change by preventing flooding in instances of cloudbursts and extreme rain. They are located in three larger Danish cities and, at the time I conducted my interviews and observations, were at different stages of planning: One was 2/3 finished, with only 1/3 of the area waiting to be built. One was still in the drawing and calculation phase, and one had just been selected as a planning project and was about to be developed in more detail. In the three projects, I have talked with different people from the municipality, along with the utility company, and with consultants employed on the projects and from different professions (engineers, landscape architects, and urban planners). I also draw on interviews with other actors from other projects, and on interviews with key people in the field—from universities, consulting companies, and interest groups—who were not directly affiliated with the projects. I have conducted 31 interviews with 33 people, which took from 1 to 2.5 hours. The interviews were semi-structured and focused on work practices and the cooperation between different professions. I also draw on observations made during a brief one-month-long fieldwork in an engineering consultancy and at meetings.

The theoretical contribution from this paper is the suggestion of the concept of a *hinge object*, a supplementary concept to the original idea of a boundary object developed by Star and Griesemer (1989). This concept is developed through an abductive analysis of the empirical data (Timmermans & Tavory, 2012). Using this abductive approach, the analysis is informed theoretically, but the theory is not used either to verify, falsify, or modify the theory, as in the case of deduction. Instead, I have entered the field with an understanding of theories and developed my theoretical

repertoires throughout the research process, which has given me the ability to modify and extend existing theories in novel ways (in line with what is described by Timmermans and Tavory, 2012, p. 173). My analytical departure was to understand the inter-professional work and coordination that was practiced in the field of urban rainwater management, informed by the sociology of professions, especially Abbott's (1988, 2005). As I worked with the interview data and my fieldnotes, the concept of LAR emerged as an object that in important ways helped actors coordinate and compromise in their daily inter-professional work. This resonated with the idea of a boundary object (also part of my theoretical ideas about professional work) that makes possible cooperation across multiple, different professional worlds. Yet informed by my theoretical understanding of a professional ecology coexisting with other ecologies, I saw that LAR did more than coordinate among professions. It also made possible alliances on a different level, namely, between the different ecologies (in the language of Abbott). LAR functioned in the language of Abbott as a hinge between the different ecologies. Describing LAR as a hinge object is, therefore, an addition to the concept of boundary objects, a particular kind of boundary object that coordinates not only between the different professional worlds, but also across ecologies.

Everyday rain and cloudbursts: Engineers working with LAR

Historically, engineers have had a major impact on and control over the area of urban rainwater management. In Denmark, the Danish Society of Engineers has a committee, The Wastewater Committee (called in Danish, and from now on, SVK), which has been very influential in establishing standards and norms for practice in urban rainwater management. The members of SVK are academics, consultants, employees from the utility companies, manufacturers (e.g., of pipes), and also governmental actors. The only requirement for volunteering as a member is that you belong to the Danish Society of Engineers. SVK has historically influenced the Danish state and legislation by publishing documents on "good engineering practice." These documents have been adopted as Danish standards, not officially, but because all engineers use them and therefore risk being accused of not following good practice if they fail to comply with the recommendations (this actually occurred, when a municipality was convicted of not complying with best practice, based on the recommendation of SVK, in a case of flooding). When defining how urban rainwater management and LAR should be practiced, SVK therefore plays a major role. SVK is a professional committee, but since its members are also from both the political institutions and universities, it could be characterized as a *hinge organization* that link engineers and other ecologies in relation to urban rainwater management.

SVK has been central in developing the definition of LAR. LAR as a concept was invented in the 1990s by an engineer employed at the Technical University of Denmark and actively involved with SVK. Inspired by the Swedish approach to rainwater drainage and as a strategy for developing a research field, he coined the term LAR:

Yes, well, in that period, we invented the name LAR ... It was also the case at that time, when we produced our mathematical models, that they also needed a name. Everything needed some sort of name and abbreviation ... so I said to Paul [his colleague at the university]: "We need to...now we need to make this a slogan that we can run with," and then I came up with the name LAR.

This naming of LAR can be characterized as a way to define a settlement in the university by inventing a "slogan" to show its importance as a research field. LAR,

then, was initially an attempt to create an area for research defined and controlled by academic engineers. The academic engineers working in this area wrote two important documents on LAR in the early 1990s: one published by the Environmental Agency and one by SVK. In both these documents, LAR is described as techniques for managing rainwater without leading water into the sewers. The idea of using LAR to create greener cities and better urban spaces is not mentioned.

The university actors' attempt to create a settlement of LAR in the university ecology was hinged on to the political ecology (The Environmental Agency) and the professional ecology (via SVK). This work was done by specific academics, who acted as avatars in the different ecologies, where they wrote about LAR and thereby exported the concept into the professional and political arenas.

After these two documents were published in 1992 and 1994, almost 20 years passed without either of the organizations mentioning LAR again. But in 2011, the same year that Copenhagen was flooded by cloudbursts, SVK published a second document on LAR, in which the dimensioning criteria from 1994 was updated. Here, LAR is described as having two functions: it is a drainage technology but can also be used as a tool for urban design.

LAR installations in the form of newly built green areas in roads or buildings can be established for the benefit of the city and people. If LAR-installations are meant to be used in this way, even relatively small constructions can be very useful. But if they are meant as complete or partial replacement for sewers, they have to be able to protect against flooding, which requires big constructions. (SVK 2011, p. 2)

This idea of LAR as a tool for planning green and better urban spaces is new to SVK's 2011 definition of LAR. In the interval between SVK's first and second documents on LAR, landscape architects (as I will show later) were actively working to define LAR as a tool for planning greener and bluer cities. This definition is then adopted by the engineers in the 2011 document. The documents from SVK describe the formalized rules for designing LAR constructions and how much water they should handle. They are related to earlier documents from SVK on dimensioning draining systems and climate adaptation. LAR constructions thus are being standardized as a technical part (but only a part) of the drainage and sewage system related to measures for the different amounts of rain they should accommodate.

This professional standardization by SVK is a way to clearly define LAR in engineering terms by relating it to earlier professional standards. What is important for engineers is that LAR is one solution, but not the only one, for managing urban rainwater. For most engineers, LAR solutions are part of a larger system of different methods for managing urban rainwater. Pipes underground remain a component of these methods, and guiding water along the surface and away from certain areas, but not draining it locally (as is implied by LAR), is another method. One engineer from a private consultancy firm describes a LAR project he has been working on:

That's more like everyday LAR. It's also there that you have to distinguish between LAR or climate adaptation. They're two different things ... Because climate adaptation aims to handle these extreme events, either flooding from the sea or an extreme rain event. Whereas LAR is more about managing water locally, and there can be infrastructure advantages to it.

Several engineers talk about LAR as involving methods for handling the increased amounts of everyday rain but specify that other methods—for example, leading water on the surface directly to recipients—are needed for managing extreme events (such as the Copenhagen cloudbursts), which are also increasing. An engineer explains: "It [LAR] is a tool in the toolbox, in the same way that a sewage pipe is."

This is not a view of LAR that is shared by all professions. An engineering professor makes the following comments about landscape architects:

I have great respect for them, but they have a hard time understanding the scale ... No matter how much you put LAR or landscape-whatever into it, it won't solve the cloudburst problem. And if you want it out in the harbor, and there's a hill, then you must have a tunnel or a big pump. Otherwise it's impossible.

For engineers, LAR is a tool, but not the only one, to manage urban rain, and they emphasize that LAR is not the final solution. In the university ecology's fight over settlements, LAR is a central object in the area of rainwater, climate adaptation, and urban planning. In the university ecology and professional ecology, engineers and engineering professors are performing professional boundary work (Gieryn 1983, Liu 2015) in relation to landscape architects by clearly defining a line between, on the one hand, everyday rain, which can be managed with small LAR installations, and on the other, cloudbursts or extreme rain; in the view of the engineers, the more extreme forms *could* be handled with large and expensive LAR installations but should be managed with other cheaper and less comprehensive methods (methods belonging to the engineering toolbox). LAR installations—or “landscape-whatever,” as it is called by the engineering professor—do not solve the cloudbursts problem; only engineering installations like a tunnel or a big pump can do that.

Boundary work is done by engineers by assigning specific tasks to their own profession, but also by clearly defining tasks for others. One professor says: “I will not comment on which plants should be in a rain bed. But they [landscape architects] must also respect that an average rainfall is 3 mm, but the big ones are also coming, and we need to know what happens when they come.” So, landscape architects can handle everyday rain in rain beds and decide on the plants that go in there, but they cannot prevent flooding. That is an engineering job.

“Pipes on the surface”: The critique from landscape architects

In Denmark, academic landscape architects were the first to describe managing water on the surface as a way to combine drainage, flood protection, urban planning, and city greening. This approach emerged from the research project 2BG, dating from 2007, which was funded by the Danish government. At the time, the concept was not called LAR, but *landscape-based drainage*. It is worth noting that the official institution representing landscape architects is neither very strongly organized nor institutionalized and, in contrast to SVK, enjoys no strong links to the political system and the universities. Landscape architects therefore have competed for control over the area of urban rainwater management by way of projects and networks. The research project 2BG, which ran from 2007 to 2011, was central in establishing the link between drainage and a greener city. As such, the vision of the academic landscape architects was linked—both economically and normatively—with the political ecology. Later, 2BG was replaced by 19K, a network of 19 municipalities wherein the coordination between utilities and municipalities became the focus, also led by academic landscape architects. From this network grew the new network Water in Cities (Vand i byer, ViB in Danish), a very large partnership and innovation network consisting of universities, utility companies, public authorities, and private companies. Water in Cities was also partly initiated and, in the beginning, partly run, by an academic landscape architect. The network started in 2010 and is still operating today with 201 participants (knowledge institutions, public institutions, utility companies, manufacturers and contractors, consultants, and interest groups). The

network has been very influential in promoting its mission, which is “to create climate robust and sustainable cities by value-creating water management” (from the website vandibyer.dk). LAR provides a central method for implementing the mission of this network. Thus, this work by the academic landscape architects can be seen as a way to establish alliances with political institutions in the field.

At some point, the landscape architects adopted the engineering term LAR, possibly as a way to coordinate with engineers who are employed in municipalities and utilities to handle urban rainwater. But in contrast to engineers, landscape architects typically believe it is possible to create LAR installations that can handle all rainwater in cities, as well as cloudbursts. Landscape architects maintain that this has always formed part of their area of expertise (in contrast with how an engineer framed the landscape architects’ relationship to LAR, claiming that they saw an opportunity to expand their area of expertise to urban planning). When a professor of landscape architecture talks about LAR and the differences in rainfall, she emphasizes that it needs to handle everyday rain but can also handle extreme rain.

The idea is that it handles all rainwater and not just once in a decade or the cloudbursts. So, it’s an alternative to a sewer. Or it can work together with the sewers, but the idea is more that it’s an imitation of nature, while [the other solutions]—they’re more that you just transport water on the surface along some newly profiled roads ... But it’s really just the same idea as conventional sewage ... They [engineers] have raised the sewage system to the surface.

This is a way of critiquing (some of the) engineers’ approach to LAR as just another method of building sewers. For the landscape architects, this approach misses the point of LAR, which is tied to the whole water network in the city and to the possibility of creating a greener and more biodiverse city. LAR, then, for the landscape architects, is about a more “natural” approach to water and the water life cycle, which LAR imitates.

A common critique of projects in the field of urban rainwater management is that what is built is just “pipes on the surface,” or involves only raising the sewage system to the surface, as described in the quote above. This could be characterized as a critique of the engineering approach to LAR. What matters to landscape architects, then, is that LAR should do something more and something different for the city than what traditional wastewater projects can achieve. It should create more green areas and more biodiversity. Therefore, it is not enough for LAR installations to manage rainwater. Something more should come out of these projects, and that “more”—greener areas, more trees, greater biodiversity—is a job for landscape architects.

LAR as city branding: Urban planning and the political ecology

The profession of urban planning has a history, in Denmark and many other European countries (Frank et al. 2014), of being interdisciplinary. Established at the beginning of the 19th century and consisting mostly of engineers and architects, the occupation today has developed into an even more interdisciplinary field, where sociologists, geographers, and political scientists all carry out the work of urban planners. The professional association struggled in Denmark in the 1960s and ’70s to establish an educational qualification, and still struggles to maintain some sort of control over the area of city planning. Compared with engineering and landscape architecture, the profession of urban planning is much less stable and cohesive. In Denmark, although a strong tradition of comprehensive planning practice exists, planning nonetheless is embedded in architecture, engineering, and surveying pro-

grams (Frank et al. 2014, p. 38). There is still to be found, however, an official association of urban planning, along with different professional networks of urban planners, and in this sense, the field exhibits the traits of professional control.

Compared with the two other professions, urban planning is much more closely related to politics. This has probably always been the case with the profession, which, from the beginning, has been tied to the wish of cities and municipalities to control and regulate the area of the city. Urban planning as a profession has not detached from these strong political and official goals, and in Denmark, urban planners are almost entirely employed by the municipalities. Therefore, the way that urban planners think of, work with, and practice LAR is tied in many respects to the political ecology. Urban planners thus contribute to shaping the conditions under which landscape architects and engineers can enter into political alliances.

The cloudbursts in 2011, which left several streets in Copenhagen under water, became a turning point in the public debate about rain and climate. In the field of urban rainwater management, this event is referred to frequently as the point in time when politicians became aware of the problem and were ready to act upon it (mostly in bigger Danish cities, and especially in Copenhagen). The municipality of Copenhagen responded directly to the 2011 cloudbursts by publishing a “cloudburst plan,” in which surface-based solutions should form a central part of the protective measures.

In case of cloudburst, the water can be drained both over- and underground. Solutions on the surface are both easier and cheaper to create. At the same time, we can have new blue and green breathing spaces and recreational areas by combining surface-based solutions with plants and trees. Therefore, they will be preferred in those parts of the city where there’s room for it. (The Cloudburst Plan of the Municipality of Copenhagen 2012, p. 2)

In urban planning and the political ecology, LAR is a way to green the city in a sustainable manner for the benefit of the people, as well as a way to optimize the city resources that are being invested in infrastructure. These investments also function to brand the city. Several actors talk about presenting rainwater projects at conferences and exhibitions, both in Denmark but also internationally. An urban planner talks about a municipal climate adaptation project with a comprehensive rainwater management plan: “I know that when the municipality is out and marketing itself abroad, then that’s thing they’re impressed with—the comprehensive plan”. Talking about presenting climate adaptation projects at international conferences, another planner emphasizes the Danish approach to urban rainwater management:

There are also larger cities in Europe that are working with climate adaptation, but they are working with it in separate sectors. I think it’s very Danish to make connections all the time ... so that the added value comes in and you get the urban development layer ... to connect urban development and climate adaptation.

The work of urban planners is closely tied to the political ecology, where LAR is a concept that helps brand the city as green and sustainable and optimizes the city resources to create greener urban spaces.

LAR as a hinge object

The network mentioned earlier, *Water in Cities*, functions as a means of coordination among the different actors and organizations involved in urban rainwater management in Denmark. Here, LAR has a prominent place in the methods discussed and used for rainwater management. Therefore, even though the different professions

and university disciplines do not completely agree on what LAR is, LAR is good enough for coordinating among the different communities of practice. “The shared vision is big and the same”, an engineer says about LAR and Water in Cities. In this context, LAR can be seen as a boundary object: a diagram that shows how water is drained and contained on the surface in relation to green areas, trees, and plants. This is the shared vision: that urban rainwater management can lead to greener cities and added urban value. There are still professional conflicts regarding the specific use of LAR, but these are minor. LAR is thus a means for professional actors to coordinate in spite of their different points of view (Trompette & Vinck 2009).

In this way, a willingness to focus not on the differences but on the shared ideas means that one of the prominent features of the field is a widespread consensus regarding both solutions and those things that still need to be studied and explored, together with the willingness of different professions to cooperate. A specific illustration of this collaborative process, where engineers and landscape architects work together, is the design of a LAR installation (a “rain garden”) in one of the projects studied. The lead road engineer describes the design process as a long and thorough debate between engineers and architects about materials, water flows, and road traffic safety.

Well, they [architects] see things differently. And maybe they’re more concerned with what color a tile should be, whereas I’m thinking: “Well, we need a curb, so let’s use granite, because we know it will hold”. They’re looking at, “Is it going to look good and beautiful?”. And I’m thinking, “But the other way is working!” Yet it would be boring if everything was made the way engineers want it, right? ... So, it helps to have the [landscape] architects on board.

When dealing with LAR in practice instead of in professional, jurisdictional closure, where one profession exercises its authority over another, professionals engage in processes of different, smaller compromises. In this case, the result is a material chosen by landscape architects because of its aesthetic value, but arranged in a way that satisfied the engineers’ ideas of road safety and maintenance (literally, the tiles around the garden are tilted 90 degrees to make the curb more robust). This episode illustrates a general idea often described in the interviews, namely, the importance of engaging in close and respectful cooperation among professions when working with LAR. There is an agreement among actors that projects cannot be successful (or even realized) if they do not involve engineers, landscape architects, and urban planners who are committed and willing to do things differently than they normally would. One could see this as a sign of an inter-professional jurisdiction forming, one that is still very fragile but emerging among the professions of engineering, landscape architecture, and urban planning. This does not mean, however, that discussions and jurisdictional battles disappear. Professions still attempt to maintain and mark dividing lines, but without definite jurisdictional closure.

As the paper has shown, both discussions and battles are taking place among professions, and these professional battles are linked to the university and political ecology. An engineering professor says: “It’s not the vision that there’s something wrong with. But when it comes down to the concrete things, there’s something that I can’t vouch for professionally.” Engineers, and especially university researchers, are doing boundary work to control their area of expertise in this new, interdisciplinary field by drawing upon the strong alliance among the engineering profession, university researchers, and the political institutions in SVK, which functions as an institutionalized hinge among the three ecologies. Here, the university actors are fighting the battle for control over the settlement of urban rainwater management and LAR. This battle is linked to the professional ecology via SVK, where the dimensioning of LAR installations is standardized as one group of methods for managing urban rain.

But why, might we wonder, do the engineers, who already control so much of this area, bother to fight the landscape architects, who are poorly organized and have already adopted the concept of LAR, which the engineers created and to some extent control? The reason might be found in the strong link between the landscape architects' version of LAR and the political versions current in larger Danish municipalities, which focuses strongly on greening the city and adding value to investments in infrastructure. This has forced engineers to engage in conversation about LAR and the green city.

A boundary object emerges through the process of work between different groups, with LAR being a particular kind of boundary object. It is created and maintained as part of jurisdictional struggles over professional control and, at the same time, links these struggles to political ideas about greener cities and to the research practices and agendas of university communities. Expanding on Abbott's idea of hinges, LAR can in this way be thought of as a *hinge object*, which makes coordination (and competition) between specific professional groups possible—and which links these groups to other ecologies.

Conclusion

The area of urban rainwater management in Denmark has changed from a largely mono-professional area of expertise, controlled by engineers, to a field where new professions also claim expertise, namely, landscape architects and urban planners. The case of LAR shows that in Danish sustainable urban drainage, there is not a clearly defined professional monopoly on the area. LAR is used by engineers, landscape architects, and urban planners, but these professionals work with and conceptualize LAR in different ways: urban planners use LAR for city branding and for optimizing the city's investment in infrastructure; engineers standardize LAR via their powerful professional organization and define it as a concept used for managing everyday rain; and for landscape architects, LAR is a model for urban development that tries to build on a natural water cycle and wherein green values are highly prioritized.

The concept of LAR is both part of a general professional coordination in this new area of expertise and part of the competition over control of this same area. As such, LAR is a boundary object that coordinates between different professions while also hinging the professional ecology with that of the state and university. I have therefore proposed the concept of hinge object to capture the way that LAR makes coordination (and competition) possible between specific professional groups, and also links these groups to other ecologies. In the case of LAR, what we see perhaps is the forming of an inter-professional jurisdiction centered on sustainable urban drainage.

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